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The Extralimital Distribution of Some Species of Coleoptera¹

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The following notes report the occurrence in Nova Scotia of *Sthereus ptinoides* (Germ.) and indicate the distribution in North America of 35 species introduced there from the Old World. Of the Old World species, ten are reported from America for the first time; previous records of two others are probably erroneous. Two, which were named and described in *Rhyssemus* Muls. and *Scolytus* Geoff. as species native to America, are considered introduced, and new synonymy is proposed for them. Confusion of introduced with native species is noted in *Stethorus* Weise and *Rbinoncus* Schön. The material recorded from Newfoundland was collected in the Northern Insect Survey, which is a co-operative project of the Canada Department of Agriculture and the Defence Research Board, Canada Department of National Defence.

The following notes supplement a paper³ published by the writer (6) in 1940. There it was suggested that ships' ballast has been an important source of European insects in Eastern Canada, and that erratic or immature distributional patterns shown by numerous species are evidence that they are introduced, rather than native, in America. Experience during the past decade has supported these opinions. Large quantities of ballast were landed at ports in the Maritime Provinces by ships seeking timber during the Napoleonic Wars, when Baltic sources were closed to British shipping. This seems to be the only historical event that will account for the fact that more European species of Coleoptera occur in that region than in any other part of North America. Nearly all of the European species that are, or were in the past, restricted to the region live on or in the soil or on low-growing plants. They live in habitats created by man and are most abundant in meadows and pastures. They avoid the forests, which are barriers to their spread, and some of the sedentary species are restricted by the forests to very small areas about old ports. For example, at Yarmouth, N.S., the writer collected four species that very rarely or never fly and which were unknown from other parts of America; two of these were very abundant, but only one was found beyond the borders of the town. Some of the species have been introduced into the Maritime Provinces more than once, as is shown by sedentary species restricted to small areas about two or more ports, and some have been introduced also to the Pacific Coast. There is no evidence to suggest that species have been introduced into the Maritime Provinces during recent years.

Parthenogenesis appears to have been an important factor in the establishment of exotic species of Brachyrhininae in Eastern Canada and in other parts of North America. Fifteen species of the group have been collected in Nova Scotia. Three of these are native; of the 12 European species, males have been noted only in *Barypeithes pellucidus* (Boh.).

List of Species

Notiophilus biguttatus (Fab.).—This species, which has not been reported previously from America, was taken at St. John's, Nfld., in 1923 and was found

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³This paper should have included Hatch's records (15, p. 117) of *Carabus granulatus* L. and *C. nemoralis* Müll.

abundant there in 1949. Some of its characters have been noted by Fall (11, p. 88); the elytra have the discal striae entire, and each has a large yellow area which is restricted to the apical half.

Clivina fossor (L.).—This species is widely distributed and very abundant on the eastern coasts of Canada. The Canadian National Collection contains specimens, collected since 1924, from St. John's and Harmon Field, Nfld.; the districts about Dartmouth and Yarmouth, N.S.; Tabusintac and Bathurst, N.B.; and Cascapedia and Montreal, Que. The first valid American record of *fossor* is that of Fall (12, p. 162), who in 1922 reported specimens taken at Montreal. According to Hatch (16, p. 118), the species has been taken in western Washington since 1937. The records from other American localities, which are listed by Hatch, refer largely or entirely to *C. collaris* (Hbst.). Most authors consider *fossor* and *collaris* distinct species. *C. fossor* measures from 5 to 6.7 mm.; dorsally it is unicolorous and usually blackish, sometimes reddish. *C. collaris* measures from 4.7 to 5.5 mm.; it is bicoloured above, the reddish elytra being somewhat paler than the pronotum and usually marked with blackish on the suture. Of the specimens seen by the writer, all from Massachusetts are *collaris*, and all from Canada and Washington are *fossor*. According to Lindroth (28, pp. 390-392), *fossor* is widely distributed in Norway, Sweden, and Finland, whereas *collaris* is lacking in this region except in southern Sweden. Jeannel (23, p. 257) failed to find males of *collaris* and concluded that the latter is probably a form of *fossor*. In view of the nature of the American populations, the European distribution, and the possibility of parthenogenesis, *fossor* and *collaris* should be considered distinct species until they have been studied properly in Europe.

Trechus rubens (Fab.).—Dr. P. J. Darlington has informed the writer that this species was taken at Lauzon, near Levis, Que., in 1926. It was taken at Harmon Field and St. John's, Nfld., in 1949. It has been reported from Nova Scotia by Lindroth (27, p. 171) and by the writer (6, p. 69).

Feronia melanaria (Ill.).—Specimens were taken at Pugwash, N.S., in 1926; at Annapolis Royal, N.S., and Campbellton, N.B., in 1947; and at Ottawa, Ont., in 1950. These are the first records for eastern America. The earliest specimen from western America, reported by Hatch (15, p. 119) as *Pterostichus vulgaris* (L.), was taken at Seattle, Wash., in 1927. Using the name *Platysma vulgare* (L.), Hatch (17, p. 148) has reported the species from western Oregon, Washington, and southwestern British Columbia and has given a description of it. The nomenclature used here follows Andrewes (1, p. 184; see note below on *Amara vulgaris*).

Curtonotus aulicus (Panz.).—Two specimens were taken at Harmon Field, Nfld., in 1949. The only earlier American record is that of Fall (13, p. 171), who took a single specimen at Louisburg, N.S., in 1929. The species is strongly characterized, for the impressed marginal line on each side of the pronotum is interrupted before the posterior angle, and the middle tibiae of the male are trituberculate on their inner margins.

Bradytus fulvus (Deg.).—This species was taken at Harmon Field and Gander, Nfld., in 1949. It has been reported from coastal localities in Quebec and New Brunswick by the writer (6, p. 69) and doubtfully from Newfoundland by Leng (26, p. 60).

Celia bifrons (Gyll.).—This species, not reported previously from America, was taken at Dartmouth, N.S., in 1947 and at St. John's and Gander, Nfld., in 1949. It falls with *C. musculus* (Say) in Horn's key (21, p. 35), but has the body more elongate, the posterior pronotal angles more prominent, and the pronotum punctured at its base from side to side. It measures from 5.5 to 6.5 mm.

Amara vulgaris (L.) [= *A. lunicollis* Schiödte].—Three specimens of this species, which has not been reported previously from America, were taken at Eastern Passage, near Dartmouth, N.S., in 1947. The species falls with *A. cupreolata* Putz. in Hayward's key (18, p. 49) and resembles the latter in most of its characters. In *vulgaris*, however, the prosternum of the male has at the middle a large, very feebly impressed but distinct fovea; only the two basal segments of each antenna are reddish; and the apex of each front tibia, near the spur, is produced and angulate. The species measures from 6.7 to 7.5 mm. The nomenclature here follows Andrewes (1, p. 184), who identifies *Carabus vulgaris* L. with the species described subsequently by Schiödte as *Amara lunicollis* and not with *Feronia melanaria* (Ill.), which is listed above.

Amara aenea (Deg.).—Specimens were taken at Port Maitland, Yarmouth, and Dartmouth, N.S., in 1947 and at Ottawa, Ont., since 1948. Darlington (8) has reported the species from Massachusetts, New York, and Connecticut.

Amara familiaris (Dufts.).—This species was taken at Agassiz, B.C., in 1919 and has been found since 1928 at Harmon Field, Stephenville Crossing, and St. John's, Nfld.; Yarmouth, Dartmouth, and Annapolis Royal, N.S.; Shediac and Tabusintac, N.B.; and St. Pascal, Que. According to Hatch (17, p. 150), who has summarized its American distribution and history, the species occurs from southern British Columbia to Oregon and from New York and New Hampshire to Rhode Island. Malkin (30, p. 285) has reported it from New Jersey.

Agonum mülleri (Hbst.).—This species, not reported previously from America, is very abundant in Newfoundland and Nova Scotia. It has been taken at St. John's, Heart's Content, Harmon Field, and Stephenville Crossing, Nfld.; and in Nova Scotia in the Halifax district, at Yarmouth, and at Annapolis Royal. Some specimens from Halifax were taken in 1897, all the others since 1947. In *mülleri* the head and the pronotum are dark green; the elytra are bronze or coppery; the first segment of each antenna, the tibiae in large part, and sometimes the femora are pale; and the third interval of each elytron bears three or four punctures. The species resembles very closely *A. seminitidum* Kby., in which the antennae and legs are blackish throughout and the pronotum is slightly less strongly transverse.

Agonum ruficorne (Goeze).—This species was very abundant at St. John's, Nfld., in 1949. It has been known in America since 1863, but only four specimens, from Maine, New Brunswick, and Nova Scotia, have been reported (6, p. 70).

Pseudophonus rufipes (Deg.).—This species was very abundant in southwestern Newfoundland at Harmon Field and Stephenville Crossing in 1949 but was not found at Gander or St. John's in the eastern part of the island. It has been reported (31) from Prince Edward Island, Nova Scotia, and New Brunswick, but it is not generally distributed in the Maritime Provinces. The earliest American specimens were taken in 1937.

Phosphaenus hemipterus (Goeze).—A single male of this lampyrid was swept from a meadow in Yarmouth, N.S., in 1947. The species, not reported previously from America, is blackish and subopaque, and has the elytra in the male dehiscent and abbreviated so that much of the abdomen is exposed. The male is said to measure from 5.5 to 7.5 mm., and the female, which lacks elytra and wings, from 7 to 10 mm.

Cantharis rufa L.—This species has been reported from Maine and Nova Scotia by McKey-Fender (29, p. 75). It is very abundant and generally distributed in the meadows of Newfoundland, Nova Scotia, and eastern New Brunswick and occurs westward along the St. Lawrence and Ottawa rivers to Montreal, Que., and Ottawa, Ont. It was not found at Ottawa until 1950. The species

has each third tarsal segment emarginate and measures from 7.5 to 9.5 mm. It is reddish-yellow, with stramineous elytra. The head sometimes has a dark area behind each eye. The pronotal disk sometimes has on each side two or three dark spots, which may unite to form an M-shaped mark. The metasternum is blackish; the abdomen is bicoloured; and the femora and tibiae are often streaked with black. The species resembles *C. livida* L., but the latter is usually larger and has the posterior tibiae, and usually the apices of the posterior femora, blackish.

Cantharis fulva Scop.—This species was very abundant in meadows at Abbotsford, B.C., in 1948. It has been reported doubtfully from Texas by Green (14, p. 211). It is not closely allied to native species and is placed in *Rhagonycha* Esch. by recent European authors. It measures from 7.5 to 9 mm. and is reddish-yellow, with the antennae, palpi, elytral apices, and tarsi blackish. The pronotal sides are straight and converge rather strongly from base to apex; the length of the pronotum equals nine-tenths of the width in both sexes.

Stephostethus lardarius (Deg.).—The only American record of this species seems to be that of Belon (2, p. 171), who recorded it from the Queen Charlotte Islands. Six specimens were swept from meadows at St. John's, Nfld., in 1949.

Stethorus punctillum Weise.—This species, not reported previously from America, occurs at Framingham, Mass., and at Vineland Station and Leamington, Ont. It is confused in collections with *S. punctum* (Lec.), from which it is separable only by characters of the genitalia. These species and *S. picipes* Csy. may be compared as follows:—

1. Labrum, palpi, tibiae, and parts of the anterior femora pale yellow..... 2
Mouth parts and legs entirely brown or blackish; not separable otherwise
from *punctum*. British Columbia to California..... *picipes* Csy.
2. Genitalia as figured by Kapur (24, p. 303). Male: paramera very slender, attenuated, almost attaining the apex of the penis; spicule straight to somewhat sinuous but never strongly bent near the free end; first of the modified tergites, to which the spicule is attached, strongly sclerotized except for a very narrow posterior margin. Female: receptaculum seminis not evident, apex of each half of ninth sternite narrowed to a blunt point. Massachusetts, Ontario *punctillum* Weise
Male: paramera ligulate, very much wider in dorsal or ventral than in lateral aspect, extending only to the apical fourth of the penis; spicule strongly bent near the free end; first of the modified tergites, to which the spicule is attached, strongly sclerotized anteriorly, the transparent posterior margin almost as wide as the sclerotized portion; other genital structures as in *punctillum*, the siphonal capsule and trab varying much as in that species. Female: receptaculum seminis quite evident; halves of the ninth sternite, apically, very broadly rounded. Nova Scotia to Manitoba, Iowa, and Kansas *punctum* (Lec.)

Tribolium destructor Uyttenb.—This name was validated (34) in 1933, and the species was described and reported (35, pp. 21, 26) from Germany and the Netherlands in 1934. The species has been reported from "Canada" by Cotton (7, p. 18); from Abyssinia by Hinton (19, p. 16), who believes it to be native to Africa; and, as *Aphanotus destructor* (Uyttenb.), from Hayward, Calif., by Blaisdell (4, p. 146). Cotton's record is based on numerous specimens found in a seed house in Montreal, Que., in 1937. This is the earliest American record. The species has been taken since 1945 at Edmonton, Calgary, and Hussar, Alta., and at Toronto, Ont.

Onthophagus nuchicornis (L.).—This species, which occurs (6, p. 72) from Nova Scotia to New Jersey and eastern Ontario, has been found at Creston, B.C.

Aphodius prodromus (Brahm).—This species, which has been reported (6, p. 74) from New York and northward, was taken at Lexington, Ky., in 1937.

Rhyssenus germanus (L.) [= *R. puncticollis* Brown (5, p. 91), *New Synonymy*.]—This species has not been reported previously from America under the name *germanus*, but comparison of the types of *puncticollis* with European specimens shows the names to be synonymous. These types were taken at Toronto, Ont., in 1925 and 1927, and the species was found abundant at Ottawa, Ont., in 1949.

Chrysolina staphylaea (L.).—This flightless species has been known (6, p. 74) since 1897 from a few specimens taken at "Halifax", N.S., and on McNab Island, Halifax Harbour. Collecting in 1947 failed to produce specimens at Halifax, but the species was common across the harbour at Dartmouth, where it occurred in meadows over an area six miles long and up to five miles wide. It appeared to be restricted by the forests to this small area. The Museum of Comparative Zoology and the U.S. National Museum have specimens of *staphylaea* from Queens County, N.S.

Mantura chrysanthemi (Koch).—For several years Mr. C. A. Frost has been taking this species at Framingham, Mass., from its food-plant, *Rumex Acetosella* L. The species has not been reported previously from America. It resembles *M. floridana* Crotch. In the latter, which feeds on several large species of *Rumex*, the colour is usually paler, the pronotum and elytra are more continuous in outline, and the pronotal impressions are deeper.

Tropiphorus obtusus (Bonsd.).—This species has been known (6, p. 74) in America from two specimens, tentatively identified, that were collected at Yarmouth, N.S., in 1933. The identification has been verified. In 1947 the species was found common in meadows at Yarmouth and six miles to the north at South Ohio. It is undoubtedly restricted to a very small area.

Barynotus schönberri (Zett.) and *B. obscurus* (Fab.).—The writer (6, p. 75) confused these species under the name *obscurus*. A specimen from Newfoundland, which was reported as *schönberri* in 1876, remains in the LeConte collection and belongs to that species. The writer's specimens from Cape George, N.S., and Tabusintac, N.B., also represent *schönberri*; his other records from Nova Scotia and New Brunswick refer to *obscurus*, which is common on grassland in those provinces. *B. obscurus* has been reported from Newfoundland by Hustache (22, p. 252), and *schönberri* is abundant at St. John's and Stephenville Crossing, Nfld. Authors have treated *schönberri* and *illaesirostris* Fairm. as varieties of *squamosus* Germ., and the three forms have been compared by Hustache (22, p. 253) and by Holdhaus and Lindroth (20, p. 225). The writings of these authors, however, suggest that *schönberri* is more likely a distinct species, or a well-defined subspecies as is suggested by Hustache, and that *illaesirostris* and *squamosus* are synonymous. *B. schönberri* is said to have a long sulcus on the rostrum, to be restricted in Europe to the North, and to lack males. The others are said to have the rostral sulcus lacking or short (*illaesirostris*), or rarely long (*squamosus*), and to be known only from the Pyrenees and the mountains of south-central France, where males are numerous.

Barynotus moerens (Fab.).—Six specimens of *moerens*, which has not been reported from America, were swept from a meadow at Yarmouth, N.S., in 1947. The three species of *Barynotus* may be separated by the following key.

I. Rostrum with two longitudinal furrows on each side of the median sulcus.
Second and third elytral intervals without setae. Yarmouth, N.S.

moerens (Fab.)

Rostrum with no more than a trace of a single furrow on each side of the

- median sulcus. All elytral intervals with setae, at least on the apical declivity 2
2. Scales of head and rostrum numerous and conspicuous; scales of pronotal disk numerous, concealing about half of the integument. Basal angles of elytra right, the elytral sides oblique just before the angles. New Brunswick to Newfoundland *obscurus* (Fab.)
- Head, except at extreme base, and rostrum with very few scales; scales of pronotal disk sparse, concealing much less than half of the integument. Basal angles of elytra acute, the elytral sides sinuate immediately before the angles. New Brunswick to Newfoundland *schönherri* (Zett.)

Philopedon plagiatus (Schall).—This species was taken at Dalvay and Brackley Beach, P.E.I., in 1940 and 1941. It has been recorded (6, p. 76) from eastern New Brunswick and the Magdalen Islands.

Brachyrbinus rugifrons (Gyll.).—This species is abundant at St. John's, Nfld. It has been reported (6, p. 76) in America only from Sydney, N.S.

Trachypbloeus bifoveolatus (Beck).—A single specimen was taken at Fernie, B.C., in 1934. The species was found abundant at Montague, P.E.I., in 1948 and at Ottawa, Ont., in 1949. It has been reported (6, p. 77) previously from Nova Scotia and New Brunswick, where it is very abundant, and from central New York.

Sthereus ptinoides (Germ.).—A single worn but living specimen of *ptinoides* was found beneath a log on the beach at Kelly Cove, Yarmouth, N.S., in June, 1947. The species is native to the coasts of Alaska and northern British Columbia, where it is said to live beneath driftwood. As it has not been taken in other regions, it cannot be native to Nova Scotia but is evidently introduced and established there.

Ceutorhynchus erysimi (Fab.).—This species, not known previously from America, was taken at St. Catharines, Ont., in 1948 and at Uxbridge, Ont., in 1950. The specimens from Uxbridge were said to be destroying seedling turnips. The species measures about 2 mm. in length. It is entirely black except for the elytra, which are green or blue-green. It differs from American species that resemble it in colour in having the middle and hind femora mutic and in being slightly smaller. In *erysimi* the tarsal claws are not toothed, the antennal funicle consists of seven segments, and white scales are not condensed on the median line of the pronotum or behind the scutellum. The species is said to feed on various crucifers.

Rhinoncus castor (Fab.) and *R. pericarpinus* (L.).—Except for *longulus* Lec., the species of *Rhinoncus* occurring in America have been confused. The Palaearctic *castor*, evidently introduced to both the eastern and western coasts of America, is very abundant and has been confused with the native *pyrrhopus* Boh. The species commonly identified in America as *pericarpinus* (Fab.) 1801 [= *pericarpinus* (L.) 1758] is native and should be known as *triangularis* (Say). The Palaearctic *pericarpinus* is abundant at St. John's, Nfld., and is represented in the U.S. National Museum by a single specimen taken in 1948 at Orient, Long Island, according to Mr. L. L. Buchanan, who has supplied the writer with records from that collection for the other species. The earliest specimens of *castor* were taken at Clementon, N.J., in 1895 and in Hastings County, Ont., in 1901. The five species of *Rhinoncus* now known in America are compared in the following key.

1. Body elongate, its length subequal to twice its width. Eyes separated by a distance not quite as great as the diameter of an eye, their inner margins not elevated above the level of the front, their outer margins not covered in repose by the prothorax. Pronotum without trace of tubercles. Elytra

roughened but not tuberculate. Black or black and red above. Males with the middle tibiae unguiculate, the other tibiae mutic. Length 2.2 to 3.3 mm. Quebec to Alberta; said to extend to Florida and California and to feed on *Polygonum*. *longulus* Lec.
Body stout, its length distinctly less than twice its width. Eyes separated by a distance at least as great as the diameter of an eye, their inner margins elevated above the level of the front, their outer margins covered in repose by the prothorax. Pronotum usually with a small tubercle on each side. Elytra with very small, acute tubercles, at least on the apical umbones, except in *pericarpinus*. Males with at least two pairs of tibiae unguiculate 2

2. Pronotal tubercles obsolete. Elytra roughened but lacking acute tubercles even on the apical umbones. Pronotum and elytra entirely black. Males with the anterior tibiae mutic, the middle and hind tibiae strongly unguiculate. Length 2.6 to 3 mm. (Pronotum more strongly transverse and the legs slightly less elongate than in *triangularis*). On *Rumex*. St. John's, Nfld., and Orient (Long Island), N.Y. *pericarpinus* (L.)
Pronotal tubercles distinct except in *triangularis*. Elytra with acute tubercles. 3
3. Length 3 to 4 mm. Elytra with acute tubercles only on the apical umbones. Elytra and sometimes the anterior margin of pronotum red or reddish-brown, the elytra always at least slightly paler than the black pronotal disk. Males with the anterior and middle tibiae rather strongly, the hind tibiae feebly, unguiculate. On *Polygonum*. Quebec to Alberta, Texas, and Virginia *triangularis* (Say)
Length 2.1 to 3 mm. Elytra with acute tubercles throughout. Males with the anterior tibiae mutic; the middle tibiae strongly, the hind tibiae less strongly, unguiculate 4
4. Fully coloured specimens entirely black above. Elytral intervals with the tubercles a little larger and the scales a trifle wider. Median line of the pronotum less deeply impressed. On *Rumex*. Newfoundland to Ontario, Illinois, and Virginia; British Columbia to Oregon. *castor* (Fab.)
Elytra and anterior margin of pronotum nearly always partly or wholly reddish and paler than the black pronotal disk. Southern Ontario and Massachusetts to Alabama, California, and British Columbia. *pyrrhopus* Boh.

Scolytus mali (Bechst.) [= *S. sulcatus* Lec. (25, p. 167), *New Synonymy*].—

All specimens of *sulcatus* that have been reported except the type, which was described from New York in 1868, have been taken since 1933. In 1933 and 1934 *sulcatus* was taken (3, p. 12) at Chatham, Maplewood, and East Orange, N.J., at Stamford and Greenwich, Conn., and at Yonkers and Staten Island, N.Y., from elm, plum, and apple. Dietrich (9, 10) reported that in 1935 *sulcatus* was common in dying apple trees in New York State and that it occurred north to Rensselaer County and west to Onondaga and Oswego counties; he stated that it was not found in the apple-growing sections of Lake Champlain and western New York. Between 1936 and 1941, *sulcatus* was taken (36, p. 540) at several other points in western and central Connecticut, and cherry and pear were noted as additional hosts. In 1938 Pechuman (32) reported that *sulcatus* occurred in New York north to Willsboro, on the southern shore of Lake Champlain, and west to Ithaca and Oswego. He noted that *sulcatus* was especially common in southeastern New York and suggested the possibility that it was an introduced species spreading north and west from the region about New York City. He noted also that *sulcatus* was considered identical with the European *mali* by Dr. K. G. Blair, and he mentioned peach and mountain ash as additional hosts. Although Pechuman was unable to find *sulcatus* in the region in 1938, he reported

(33) conspicuous damage by it in 1940 and subsequently to sweet cherry in the fruit area of western New York. In 1945 the writer found *sulcatus* abundant in apple in Quebec up to 20 miles north, and 15 miles northeast, of Lake Champlain; it could not be found northward even in the Richelieu Valley. The species was found in apple at Vineland Station, near Niagara Falls, Ont., in 1949. The writer is unable to distinguish specimens of *sulcatus* and *mali*, and their food-plants are the same. The history and distribution of *sulcatus* are strongly suggestive, as was noted by Pechuman. It seems necessary to conclude that *sulcatus* and *mali* are one species.

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Descriptions of Larvae of Forest Insects. *Plagodis, Anagoga,* *Hyperetis* (Lepidoptera: Geometridae)¹

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In his recent revision Rupert (1949) has focused attention on the geometrid genus *Plagodis*. In the present paper the writer presents descriptions of larvae of three of the four Canadian species in this genus and of the larvae of *Anagoga occiduaria* (Wlk.) and *Hyperetis amicaria* (H.-S.). Forbes (1948) notes that these three genera make a neat subgroup in the tribe *Anagogini* and indicates that there are differences in the larvae. From studies during the summer of 1949 it was determined that there are differences in these larvae; and the differences, along with the similarities, are set forth in this paper.

Plagodis phlogosaria approximaria Dyar

(Description of one larva, Forest Insect Survey, record no. '49 Alberta 806E, collected by R. R. Stanley from alder at Cameron Falls, Waterton Lakes National Park, Alberta, on July 26, 1949. This larva pupated September 29 and emerged as a female moth on February 2, after 19 days of artificial incubation at approximately 68°F.).

Penultimate Instar.—Head width 1.45 mm.

Ultimate Instar.—Head width 2.0 mm. Body 25 mm. in length and 2.3 mm. in width. Integument of body smooth. Dorsal humps or ridges present on the mesothorax and fifth and eighth abdominal segments, the largest being on the fifth and the smallest on the eighth. Ground colour of body grey; middorsal line poorly defined. Dorsum on abdominal segment 1 striped as follows: greyish-red to setae beta, then a broad white line, remainder of side greyish-red. Thorax greyish-red, with a pair of white patches in front of the hump on the mesothorax. Except segment 1, abdominal segments reddish; the areas anterior and posterior to the hump on segment 5 paler than the remainder of the dorsum. This hump dark brown on the crest, bordered anteriorly by a grey crescent. Contiguous to the hump a pale-brown crescent, which becomes dark brown at the anterior edge. Spiracles and surrounding setae of abdominal segments 2 to 4 inclusive in grey patches. On each of abdominal segments 1 to 5 a fine white line in the subventral area. Midventral line pale with a fine dark line running throughout its length. Integument of head rugulose. Head grey with much dark-grey marking in patches on apices, and to a limited extent, on the frons. Epicranial index 1.67. Prothoracic shield greyish-red. Anal shield grey with brown pits. Setigerous tubercles of dark-brown papillae set on small, brown, convex pinacula; setae of moderate length, brown, pointed. Tubercles bearing setae sigma appearing to

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naked eye as five pairs of brown dots along the midventral line on each of abdominal segments 1 to 5 (Fig. 1, A). Spiracles circular, with dark-brown rims and pale-brown or orange centres. Thoracic legs grey with brown spots; prolegs grey with brown mottling.

Differences in size and colour from those of this larva as determined by a study of ten other specimens: head width of penultimate instar, 1.37 to 1.50 mm.; head width of ultimate instar, 1.90 to 2.28 mm.; body 11 to 25 mm. in length and 1.3 to 3.0 mm. in width. Epicranial index 1.60 to 1.67. Crochets of ventral proleg 20 to 30 in number and divided into two groups. The most important colour variation from the pattern described above is the presence in some larvae of a dark-brown oblique line on abdominal segment 1. Anterior to the spiracle this marking runs downwards and forwards. The presence or absence of the marking has no relation to the sex of the specimen so far as the writer could determine.

Mouth Parts.—Mandibles brown, with two ridges and eight teeth. Hypopharynx of usual type; spinneret stout, broad at base and conical at tip; segments of labial palpi in the proportions 3.0: 1.0: 3.0 or 3.3.

Food Plants.—Birch, basswood, black and choke cherries, apple, alder, and willow.

Distribution.—This species, in its various forms, occurs across Canada, from coast to coast. It is probably the only one of the genus in British Columbia and is the common one in Alberta.

Larvae of the variety *intermediaria* B. and McD. have been described by McDunnough (1933).

Plagodis alcoolaria (Gn.)

(Description of one larva, Forest Insect Survey, record no. '47 Winnipeg 502, collected by E. Bridgman from white birch on the Sandilands Forest Reserve, Manitoba, on July 15, 1947. This larva pupated August 15 and emerged as a male moth February 11, 1948, after 27 days of artificial incubation at approximately 68°F.).

Second or Third Instar.—Head width 0.79 mm. Body 15 mm. in length and 1.2 mm. in width. Integument of body smooth. Ground colour pale grey. Middorsal line geminate, grey; setae alpha and beta on geminate grey line; spiracular line a greenish stripe. Venter green with brown markings. Covering of head rugulose. Head dirty white with brown herring-bone markings on the apices. Prothoracic shield grey; anal shield pale grey with brown marbling.

Penultimate Instar.—Head width 1.5 mm. Body 24 mm. in length and 2.0 mm. in width. Ground colour of body pale grey; dorsum considerably suffused with reddish. Middorsal line poorly defined, red in some parts and white in others. Spiracular line reddish, with spiracles set in white patches. Midventral line a series of light elliptical patches, each with a fine red line down the middle. Dorsal humps on mesothorax and on fifth and eighth abdominal segments. Head pale grey with brown patches; those along the epicranial stem and over the apices in herring-bone patterns. Prothoracic and anal shields of the ground colour with dark punctures. Thoracic legs and prolegs pale grey with dark markings. Spiracles circular, yellow, with brown rims. Setae very short, brown, pointed, arising from dark, convex papillae; the papillae bearing setae sigma conspicuous as five pairs of dark dots; one pair on each of abdominal segments 1 to 5.

Ultimate Instar.—Head width 2.09 mm. Body 35 mm. in length and 3.0 mm. in width. Integument of body smooth. Colour and humps as in preceding instar; lines indistinct because of much reddish suffusion throughout. Anterior

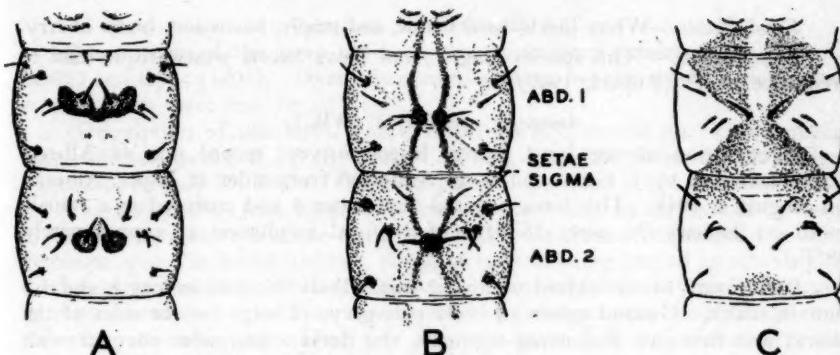


FIG. 1. Ventral aspect of abdominal segments 1 and 2 of mature larvae of

- A. *Plagodis phlogosaria approximaria* Dyar;
- B. *Anagoga occiduaria* (Wlk.);
- C. *Hyperetis amicaria* (H.-S.).

to the spiracle on the first abdominal segment, a brown oblique line running downwards and forwards. (This marking may or may not be present, it seems, for Rupert did not observe it on his larvae). Head as in penultimate instar; frons brownish, clypeus pale grey, labrum and antennae dark brown. Epicranial index 1.67. Shields, legs, spiracles, and setae as in penultimate instar. Ventral proleg bearing 20 crochets, divided into two groups.

Only two other larvae of this species were available for study.

Mouth Parts.—Not studied in this species.

Food Plants.—White birch, red oak, chestnut.

Distribution.—In Canada, this species extends "westward at least to Manitoba" (Rupert, 1949), and Bowman (1919) lists it as present in Alberta (Edmonton).

Plagodis serinaria H.-S.

(Description of one larva, Forest Inset Survey, record no. '41 Ottawa 421D, collected by H. S. Fleming from white birch at Old Chelsea, Quebec, on June 25, 1941. This larva was described on July 8 and was then preserved in alcohol).

Ultimate Instar.—Head width 2.0 mm. Body 25 mm. in length and 3.0 mm. in width. Integument of body smooth. Ground colour of body pale grey. Middorsal, addorsal, and subdorsal lines geminate, reddish. Spiracular line pale. Unlike the larvae studied by Rupert, this specimen with no dark prespiracular oblique line on abdominal segment 1. Venter striped as dorsum, but paler than that area. Dorsal humps situated and marked as in preceding species. Head covering rugulose. Ground colour of head pale grey; apices dark grey, the markings in herring-bone patterns. Frons dark grey. Epicranial index 1.50. Prothoracic shield dark grey anteriorly and light grey posteriorly; anal shield of the ground colour with brown markings and scattered punctures. Thoracic legs pale grey with fine dark spots; prolegs purplish grey on outer aspect and pale grey on inner. Ventral proleg bearing from 30 to 40 crochets divided into two groups. Setigerous tubercles of dark-brown, convex papillae set on small brown pinacula; the papillae bearing setae sigma conspicuous as five pairs of dots, those on abdominal segments 1 and 2 being most noticeable.

Mouth Parts.—Mandibles brown, with two ridges and eight teeth. Hypopharynx of usual type; spinneret as in *P. phlogosaria approximaria*; labial palpi with segments in the proportions 4: 1: 4.

Food Plants.—White birch, hard maple, red maple, basswood, black cherry.

Distribution.—“This species ranges from Nova Scotia westward at least to Manitoba . . .” (Rupert, 1949).

Anagoga occiduaria (Wlk.)

(Description of one larva, Forest Insect Survey, record no. '48 Alberta 364H, collected by J. Grant and A. E. Anderson from alder at Jasper, Alberta, on August 6, 1948. This larva pupated September 6 and emerged as a female moth on January 30, after 26 days of artificial incubation at approximately 68°F.).

Penultimate Instar.—Head width 1.2 mm. Body 20 mm. in length and 1.6 mm. in width. Ground colour of body pale grey. Except for the sides of the thorax and first two abdominal segments, the dorsum and sides covered with purplish-grey lines. Venter with fine lines. Midventral line fine, brown, broken, set in diamond-shaped areas. Head black with white patches on each side of the head and a small white patch on each apex. Clypeus pale brown, labrum dark brown; antennae black.

Ultimate Instar.—Head width 1.8 mm. Body 23 mm. in length and 2.0 mm. in width. Integument of body smooth. Dorsal hump on abdominal segment 5 and a ridge on abdominal segment 8. Ground colour of body light brown. Middorsal line brown, geminate anterior to hump on segment 5 and consisting of three fine lines posterior to hump. Dorsum brown. Laterad of setae beta on each of abdominal segments 1 to 7, a small white or yellow spot. Sides, like dorsum, with many fine brown lines. Below setae beta on metathorax and abdominal segment 1, a strong white line; elsewhere this line weak. Venter marked in much the same way as dorsum but markings finer. On abdominal segments 1 and 2, tubercles bearing setae sigma lying on short brown oblique lines (Fig. 1, B). Head slightly bifid; integument rugulose. Head pale grey with much dark-grey marking on apices and front; a herring-bone pattern along the epicranial stem. Frons brown; clypeus pale grey; labrum brown. Prothoracic shield with median white line; remainder concolorous with dorsum. Anal shield rounded, pale brown with purplish-brown pits. Setigerous tubercles in form of brown papillae set on brown pinacula; setae long, dark brown, pointed. Spiracles oblong-elliptical, with dark-brown rims and brown centres. Thoracic legs and prolegs light brown with dark-grey markings.

Differences in size and colour from those of the above larva as determined by a study of ten other specimens: head width of the penultimate instar 1.20 to 1.52 mm.; body 17 to 20 mm. in length and 1.2 to 1.7 mm. in width; head width of ultimate instar 1.80 to 2.19 mm. and body 15 to 27 mm. in length and 1.2 to 2.0 mm. in width. Epicranial index 1.8 to 2.0. Crochets of ventral proleg 13 to 16 in number in the penultimate instar and 17 to 22 in the ultimate instar; in both stages crochets in two groups. No important colour differences have been observed.

Mouth Parts.—Mandibles brown, with two or three ridges and eight or nine teeth. Hypopharynx of usual type; spinneret stout, broad at base and conical at tip; segments of labial palpi in the proportions 2.6: 1.0: 3.0 in one larva and 2.0: 1.0: 2.5 in another.

Food Plants.—Alder, white birch, raspberry, shrubby cinquefoil.

Distribution.—In Canada this species occurs from British Columbia east at least to Quebec.

Hyperetis amicaria (H.S.)

Descriptions of the larva of this species have been presented by Packard (1890) and Dyar (1904). Dyar observed five stages, but this writer believes that in some cases there may be six stages.

(Description of one larva, Forest Insect Survey, record no. '47 Winnipeg 809, collected by H. R. Wong and W. Ewart from dogwood at Pine Ridge, Manitoba, on July 30, 1947. The larva pupated and died while overwintering).

*Third Instar.*³—Head width 0.89 mm. Body 7 mm. in length and 0.5 mm. in width. Ground colour of body pale yellowish-green. Middorsal line fine, geminate, grey, in broad, reddish, dorsal stripe extending laterad to setae alpha. Setae beta in whitish-green line. Spiracular line pale yellowish-green. Anterior to ventral prolegs and between central and anal prolegs a rosy stripe; midventral line pale yellowish-green. Head pale yellowish-green with a continuation of the reddish middorsal stripe down each side of face to antennal base. Prothoracic shield concolorous, the median dorsal reddish stripe divided by a fine line of the ground colour. Anal shield of the ground colour with rosy suffusion. Thoracic legs hyaline; prolegs pale green.

Fourth Instar.—Width of head 1.19 mm. Body 12 mm. in length and 0.7 mm. in width. Markings as in third instar.

Fifth Instar.—Head width 1.51 mm. Body 18 mm. in length and 1.6 mm. in width. Ground colour of body dull red. Sides of thorax pale yellow. Midventral line a row of pale spots. A slight hump on dorsum of the fifth abdominal segment. Ground colour of head pale yellow. A rosy line extending over each side of head down almost to the antennal base. Much rosy suffusion on each side of head.

Sixth Instar.—Head width 2.2 mm. Body 30 mm. in length and 2.5 mm. in width. Ground colour of body dull red. On the fifth abdominal segment a brown hump, bordered anteriorly by white, and over the dorsum of the mesothorax a brown band. Head white with much red suffusion.

(Description of one larva, Forest Insect Survey, record no. '46 Winnipeg 1073, collected by the writer from red osier dogwood at Winnipeg, Manitoba, on September 12, 1946. This larva pupated September 18 and emerged as a female moth on January 31, after 25 days of artificial incubation at approximately 68°F.).

Ultimate Instar.—Head width 1.83 mm. Body 25 mm. in length and 2.3 mm. in width. Integument of body smooth. Ground colour of body dull red, resembling the colour of a twig of red osier. Body reddish except for the portion of the venter lying between the ventral and anal prolegs, this portion being grey. Dorsal hump on fifth abdominal segment white with a pair of brown spots. Integument of head densely covered with fine convex granules. Head reddish, pale on parietals bordering the adfrontals. Prothoracic shield dull red with a pale median line; anal shield dull red with dark pits. Setigerous tubercles consisting of small, brown papillae set directly on the integument (Fig. 1, C). Setae of moderate length, brown, pointed. Spiracles with dark-brown rims and yellow centres, and oval in shape. Thoracic legs and prolegs of ground colour.

Differences in size and colour from those of the mature larvae described above, as determined by a study of ten other specimens, as follows: head width 1.70 to 2.20 mm.; body 23 to 36 mm. in length and 1.6 to 3.0 mm. in width. Epicranial index 1.0 to 2.0. Crochets of ventral proleg from 10 to 20 in number. Ground colour varying from yellow through pale grey to dull red. Subdorsal

³The number of this and subsequent instars was determined by comparing the head width of this larva with the head width in Dyar's description.

and midventral lines sometimes indicated by pale spots. Ground colour of head pale grey or pale yellow.

Mouth Parts.—Mandibles brown, with two ridges and eight teeth. Hypopharynx of usual type; spinneret broad at base, conical and pointed at tip; labial palpi with segments in the proportions 1.5: 1.0: 2.5.

Food Plants.—Red osier dogwood, saskatoon, ironwood, meadowsweet, alder, and beech.

Distribution.—This insect is found from coast to coast in Canada.

Discussion

From a study of these descriptions of larvae of the genera *Plagodis*, *Anagoga*, and *Hyperetis*, one notes certain similarities. All of the mature larvae have a dorsal hump on the fifth abdominal segment and a ridge on the eighth abdominal segment. The integument of the body is smooth. In the last instar, the width of the head is approximately 2.0 mm.; the crochets on the prolegs are separated into two groups. Although not mentioned in the descriptions, setae theta on the abdomen are absent and setae beta on the anal shield are closer to each other than to setae kappa. In the writer's key (McGuffin, 1946), the mature larvae of these genera will fall into couplet 3; since the crochets on the ventral prolegs are divided into two groups, these larvae stand apart from those of *Semiothisa*, *Eufidonia*, and *Melanolophia*.

Key to Genera

1. Dorsal hump present on mesothorax; setae sigma on abdominal segments 1 and 2 arising from circular brown patches (Fig. 1, A); crochets on ventral proleg 20 to 40 in number; first and last segments of labial palpi approximately equal in length *Plagodis*
Dorsal hump absent on mesothorax; setae sigma on abdominal segments 1 and 2 arising from oblique brown patches or pale areas (Fig. 1, B, C); crochets on ventral proleg 25 or fewer in number; first and last segments of palpi subequal in length 2
2. Head bifid; setae sigma on abdominal segments 1 and 2 arising from oblique brown patches (Fig. 1, B) *Anagoga*
Head normal; setae sigma on abdominal segments 1 and 2 arising from pale areas (Fig. 1, C) *Hyperetis*

Acknowledgments

For the text figure in this paper the writer is indebted to James Grant, formerly of the Calgary laboratory but now of the Forest Insect Laboratory at Vernon, B.C. Appreciation is also due to officers of the Forest Insect Survey in Ottawa and Winnipeg for assistance in the form of material and complementary notes.

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**On a New Argentinian Mite, *Diphtheroglyphus maculata* n. sp.,
n. gen., and the Taxonomic Position of the Family
Pontoppidanidae Oudms. 1925**

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In the winter of 1939 a sample of mites from salted steer hides was sent to me from Buenos Aires for identification with the note that they were present in great numbers in this habitat. As upon examination these appeared to constitute a new species sufficiently unlike the existing representatives of the genus *Pontoppidania* to preclude its inclusion in that group, the erection of a new, but closely allied genus, seemed to be warranted. Because of the peculiar nature of its habitat and because of its association with hides the name *Diphtheroglyphus*¹ has been given to this group.

Genus *Diphtheroglyphus* n. gen.

The single known member of this genus, and for whom it was erected, provides us with the characters which may be used to identify this group. These are as follows: a pair of heavily pectinated setiform nuchal setae; a very large and striking gnathosoma possessed of long forcep-like toothless chelicerae and noticeable pedipalps (the overall length of the gnathosoma is almost twice that of such Caloglyphids as *Caloglyphus berlesei* (Mich.)); a modification of the typical acarid chaetotactic pattern so that setae 8 and 10² stand side by side in a paired relationship; a raised plate bearing three pairs of setae about and behind the anal suckers of the male; and a peculiar truncate seta on tarsus I.

Type of the genus: *Diphtheroglyphus maculata* n. sp.

***Diphtheroglyphus maculata* n. sp.**

Figs. 1 to 7 incl.

It was hoped originally that this description might include some details about the life-history of this species, but, as all attempts which have been made to rear the specimens in our laboratory have been futile, the description must be based solely upon anatomical details. Under what should have been natural conditions, however, they developed very slowly and followed the usual Acarid life-cycle. As yet no hypopi have been seen.

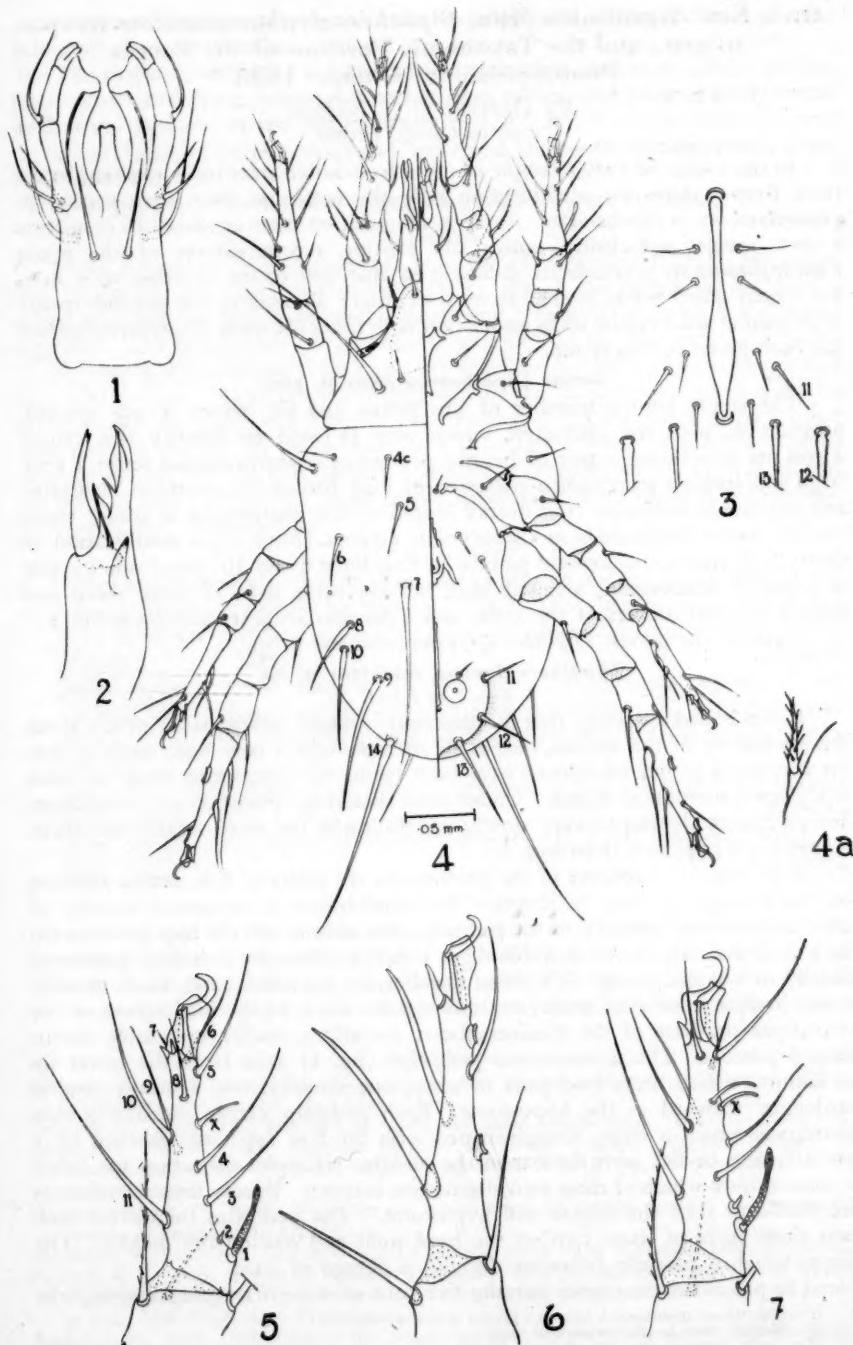
Male (fig. 1): Exclusive of the gnathosoma the males of this species measure, on the average, .35 mm. in length. The gnathosoma is composed dorsally of the chelicerae and ventrally of the pedipalps, the labium, and the hypostome. On each chelicera (fig. 2) the movable digit, which is otherwise toothless, terminates distally in a jagged point. The fixed member, on the other hand, bears mesially a thin hyaline membrane pulled out into spurs. Close to the hinge-point of the two digits the base of the chelicera bears dorsally a readily noticeable thorn-shaped process. The three-jointed pedipalps (fig. 1) arise from the lower lip or labium, which bears two pairs of setae, one dorsally, one ventrally, and is prolonged forward as the hypostome. Each pedipalp carries mesially a thin membrane which is either trough-shaped with the free edge strengthened by a bar of chitin or flat with the bar in the middle. (Careful dissection has failed to demonstrate which of these two alternatives is true.) Basally these membranes are confluent with the labium and hypostome. The pedipalps themselves each bear three pairs of setae, two on the basal joint and one on the middle. The distal, which is partially bifurcate distally, is devoid of setae.

The propodosoma carries dorsally five pairs of setae of varying lengths,³ the

¹From the Greek diphthero a hide and glypho to cut or carve.

²See Nesbitt, 1945 for the terminology used.

³The inner humeral seta (No. 4c—vide Nesbitt 1945 for terminology) which is equal in length to genu I has been taken as the basis for comparison.



rostral (.75 x 4c); the inner propodosomatic (.75 x 4c); the outer propodosomatic (5 x 4c); the cervical (.4 x 4c); and the pseudostigmatic organ (.4 x 4c); and laterally, a plump heavily pectinated nuchal seta (= Grandjean's organ Δ) just behind the insertion of the gnathosoma. Ventrally there is only one fairly large anterior interepimeral bristle between the first two epimera. Just anterad of the pseudostigmatic organ and at the base of coxa I may be seen under certain conditions a small slit which may have stigmal functions (vide Grandjean, 1937 for a similar interpretation). The opisthosoma bears dorsally ten pairs of setae: the inner (No. 4c), middle (.8 x 4c), and outer (3.3 x 4c) humerals; the first (No. 5 = 1.3 x 4c), second (No. 6 = 1.3 x 4c), and third (No. 7 = 4.5 x 4c) lumbars; the outer (No. 8 = 2 x 4c), middle (No. 10 = 2.5 x 4c) and inner (No. 9 = 3.4 x 4c) submarginals; and the marginal (No. 14 = 5 x 4c) setae. The bases of the outer and middle submarginal setae are placed so close together as to give their setae the paired appearance characteristic of this species. Ventrally the opisthosoma bears one pair of inferior humeral setae, one pair of posterior interepimeral bristles, three pairs of paragenital bristles, one pair of minute anal bristles, and three pairs of larger setae located on a semisclerotized plate behind and about the anus and the anal suckers, viz., the anterior and posterior postanals, and the ventral submarginal setae. The heavily sclerotized aedeagus is anteriorly pointed and placed between the fourth epimera and coxae.

As the pretarsal segments of all four legs have the usual complement of setae found in acarid mites, and as they are adequately figured (vide fig. 1), there is no need to comment upon them here. The first and fourth tarsi, however, exhibit slight modifications of the usual pattern, which, as far as I know, are not found in any other member of the family. Tarsus I (vide fig. 5) has a setal pattern vaguely reminiscent of a member of the genus *Tyrophagus*. In addition to the setae usually found on these mites, and which are here numbered (vide Nesbitt, 1945) because they are in somewhat different positions, there is a small rod-shaped or truncate seta of doubtful homology and function. Tarsus II is similar to tarsus I except, that the "extra" seta referred to above is missing and, as is usual in acarid mites, there is no microsense seta (No. 2). Tarsus III does not exhibit any unusual features. Tarsus IV (vide fig. 6), on the other hand, is different in that the terminal seta is located between the two suckers rather than distad of the distal sucker. It likewise bears two conspicuous thorn-like lateral setae.

Female: Exclusive of the gnathosoma the females of this species measure, on the average, .42 mm. in length. As the dorsal, ventral, and tarsal chaetotactic patterns of both sexes are similar, with the exceptions about to be discussed, there is no need to describe the female. The vulva is located between the epimera of the fourth pair of legs. The anus (vide fig. 3) is flanked laterally by four pairs of small bristles and posteriorly by the anterior postanal setae (No. 11), which in this sex is somewhat shorter than its counterpart in the male. The ventral

Explanation of Figures

- Fig. 1 Ventral view of gnathosoma showing pedipalps.
Fig. 2 Lateral view of chelicera.
Fig. 3 Ventral view of the terminal portion of female opisthosoma showing anus and surrounding setae.
Fig. 4 Dorsal left, ventral right view of male.
Fig. 4a Enlarged view of nuchal seta.
Fig. 5 Tarsus I of male.
Fig. 6 Tarsus IV of male.
Fig. 7 Tarsus I of female.

submarginal (No. 12) and the posterior postanal (No. 13) setae are fairly large and conspicuous. Tarsus I (vide fig. 7) is similar to that of the male except that there are two rather than one rod-shaped, truncate setae.

Notes: When the specimens described above were first examined, I thought that, while we had a new species, it could be assigned quite easily to the genus *Pontoppidania* Oudoms., 1923. The fact too that *Tyroglyphus littoralis* Halbert 1920, the type of the genus, came from rotting seaweed which, like salted hides, has a high salt content made this view acceptable. A critical study of Oudemans' drawings⁴ however revealed the fact that although the species under examination was undoubtedly closely related to *P. littoralis* it could not for a variety of reasons be placed in the same genus if established taxonomic practices in acarology were to be followed.

Certain differences namely: i) the complete absence of any setae in the place where the paired setae (Nos. 8 and 10) are found on the opisthosoma of the new species; ii) the presence of a gnathosoma which is shorter by one-half and equipped with relatively shorter chelicerae and pedipalps; iii) a reduction in the length of such dorsal setae as Nos. 7, 11, and 13, by two-thirds;⁵ iv) the lack of a sclerotized plate about the male anus and copulatory suckers; and v) the setiform nature of the fourth tarsal setae in *P. littoralis*—are great enough to establish the identity of these two species and to demonstrate that their taxonomic position would be more adequately expressed if they were placed in separate but closely related genera.

The specific name *maculata* has been given to the new species out of deference to Mr. Dedlow of the Swift International Company of Buenos Aires who requested that this name be used and through whose courtesies I received this material.

Type Habitat: Salted steer hides. Buenos Aires, Argentina.

Holotype: ♂, Buenos Aires, Argentina, January 1949 (Dedlow); No. 5924 in the Canadian National Collection, Ottawa. (The aedeagus is reversed on the type specimen which is on the same slide with a paratype female).

Allotype: ♀, same data, on the same slide with a paratype male.

Paratypes: 4 ♂♂, 4 ♀♀, 1 immature ♀, same data, mounted on 6 slides. There is also a slide of dissected specimens. In addition to the mounted material there is a fairly large culture of living specimens.

The taxonomic position of the established genus *Pontoppidania* and associated with that of the genus *Diphtheroglyphus*⁶ must now be considered. The former group has had a varied career. It was established in 1923⁶ by Oudemans who believed that Halbert's *Tyroglyphus littoralis* possessed characters which precluded its inclusion in the last mentioned group. The following year, however, the Dutch author withdrew his genus, stating that it should be placed in synonymy with *Calvolia* Oudoms. 1911. In 1926, either overlooking the 1924 note or having changed his mind about *Pontoppidania* being a synonym of *Calvolia*, he used the name *Pontoppidania littoralis* in drawing attention to the fact that Halbert had erred in the original description in declaring that there was only one sucker on tarsus IV of the male instead of two. Oudemans'

⁴Nos. 1555 and 1556 in the Oudemans collection in the Rijksmuseum van Natuurlijke Historie, Leiden. These figures and those published by Halbert in 1920 do not correspond in the manner one would expect from drawings made from the same material but as Oudemans was a careful draftsman and stated that he used Halbert's types for his figures, I have accepted the Dutch author's work as being the more accurate and have based my conception of this species upon Halbert's descriptions and Oudemans' figures. So far my attempts to borrow Halbert's type specimens from Ireland or to collect similar material from the seacoast of North America have not met with any great success.

⁵Halbert's drawings differ, among other things, from Oudemans' in showing seta No. 7 approximately the same length as I have figured it, whereas Oudemans drew it one-third as long.

⁶The original description reads: "Tyroglyphus-achtig: structuur glad; mandibels schaarvormig; ambulacra met caruncula, die de finke glauw draagt; geen schildje; scheidinglijn duidelijk; ♂ met zuignappen bij den aars en met eene zuignap op tarsus iv" Oudemans 1923: 207.

position, however, was not clarified until he stated in 1927 that he had made a mistake in placing *Pontoppidania* and *Calvolia* in synonymy, since the hypopi of the latter, in possessing "eye spots", differed from those of the former. In a key in the same paper he makes reference to the family Pontoppidiidae,⁷ which he claims to have erected in 1925. As a careful review of the literature has failed to reveal any reference in that year to the creation of such a family, I presume that we must either accept Oudemans' claims that such reference was made, or assign a new date, viz., 1927 to the family name, on the assumption that reference to a group in a key is tantamount to a description. Such essentially was the position adopted by Vitzthum (1941-43) who placed the genera *Pontoppidania* Oudms. 1923 and *Calvolia* Oudms. 1911 in the subfamily Pontoppidiinae Oudms. 1925 of the family Tyroglyphidae Donnadieu 1868 (Supercohors Acaridae Latr. 1802, subordo Sarcoptiformes Reuter 1909).

The question now arises as to whether the taxonomic position of the genera *Pontoppidania* and *Diphtheroglyphus* is best explained by following Oudemans' practice of regarding them as subgroups in a family Pontoppidiidae or whether their affinities with the other acarids would be more accurately expressed if they were placed in a subfamily Pontoppidiinae of the family Acaridae. This latter, as noted above, was essentially the position adopted by Vitzthum but, as Ewing and Nesbitt (1942) have pointed out, the name Acaridae, rather than Tyroglyphidae, should be used for this family. My reason for advocating such a change is that in all essential respects, such as the dorsal and tarsal chaetotactic patterns (vide Nesbitt 1945), there is little fundamental difference between the representatives of the genera *Pontoppidania*, *Diphtheroglyphus*, and such established and well known genera as *Tyrophagus*, *Caloglyphus* or *Rhizoglyphus*. The character which really distinguishes the two groups first mentioned, and to which Oudemans made no reference until 1927, is the possession of large plump, pectinated nuchal setae which stand free of the body. I refer to the structures which Oudemans, for reasons best known to himself, called the "pinch-organs", organs which, I believe, could have no function other than sensory (vide fig. 4a on the accompanying plate).

When these organs are used as the chief diagnostic character, the family Acaridae falls quite naturally into three subgroups or subfamilies:

- a) those in which the nuchal setae (or their homologues) are thin, root-like structures⁸ adhering closely against the lateral wall of the body. (The structures usually called Grandjean's organ)..... subfamily Acarinae
- b) those in which the nuchal setae are distinct hornlike processes standing free of the body..... subfamily Rhizoglyphinae
- c) those in which the nuchal setae are distinct, heavily pectinated processes standing free of the body and readily visible in dorsal mounts..... subfamily Pontoppidiinae

On the basis of the evidence presented above I am persuaded that the genera *Pontoppidania* and *Diphtheroglyphus* would be placed in the subfamily Pontoppidiinae of the family Acaridae.

⁷"F2 Cervical hairs dorsal, minute smooth; moreover easily visible pinch organs. With suckers near anus and on tarsi IV. Pontoppidiidae Oud 1925."

⁸These structures can be seen only in lateral mounts and with the higher powers of the microscope.

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